

REMARKS/ARGUMENTS

REMARKS

1. The amendment of claim 1 is supported by Ar-60 in page 21 of the Specification reduces the scope by limiting Ar₁.
2. The amendment of claim 10 is supported by PO-18 through PO-20 in page 63 of the Specification.
3. The new claim of claim 27 covers a heterocyclic not in amended Claim 1. This is supported by Poly-5 in page 26 of the Specification.

COMMENTS

Claims 1, 2, 10-13 and 23-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Takimoto et al. (US 5,331,182A).

A. With respect to claim 1, claim 1 was amended so that Ar₁ represents a group represented by Ar-60. Ar-60 is a heteroaromatic group. (New Claim 27 covers a different heterocyclic group).

No heteroaromatic group is exemplified in the text or in the examples of Takimoto et al. Therefore neither Claim 1 (amended) nor Claim 27 (new) are anticipated.

Among the heteroaromatic groups, Ar-60 is used in Poly-8 in page 26 of the Specification and tested in the Example as the phosphorescent material of Organic EL Element 2-1-6 (Table 5, page 106).

In Table 7, it is shown that Organic EL Element 2-1-6 exhibits a high External quantum efficiency, a long Emission Life and, specifically, a low Driving voltage.

Takimoto et al. teach or suggest nothing about such an excellent effect of Ar-60.

Accordingly, amended claim 1 is not shown or suggested by Takimoto.

Since claims 2 and 11-14 are dependent to claim 1, the rejections of these claims should be withdrawn.

B. With respect to claim 10, claim 10 was amended so as to include the limitation "wherein the mixture comprises at least one polymer represented by Formula (2)".

As will be discussed below, the polymer represented by Formula (2) is patentable over the cited art.

Accordingly, the amended claim 10 is allowable because it requires that at least one polymer be represented by Formula (2).

Since claims 23-26 are dependent to claim 10, the rejections of these claims should also be withdrawn for the same reasons.

Claims 3-7, 9, 15-17 and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takimoto et al. (US 5,331,182A) in view of Tokito et al. (US 2003/0091862 A1).

With respect to claim 3, Takimoto et al. does not explicitly disclose the polymer containing pendent chains attached to Ar₂, as the Examiner recognizes.

The examiner states that Tokito et al. teach attaching pendent chains of hole transporting compounds [0090], such as carbazole ([0090] HT-1) and phenyl carbazole ([0095], first side chain in polymer P3, and phosphorescent complexes [0106] to the polymer backbone.

However, the pendent chains of Tokito are attached to the polymer chains of a vinyl polymer ([0095], [0097], [0130], [0147], [0153] and [0164]) and a vinyl polymer having a methyl group in the repeat unit ([0147], [0153] and [0164]). There is no suggestion of the polymer chain as disclosed by Formula (2) of the present Application is found in Tokito et al. Formula (2) is required by these claims.

In [0130] of Tokito et al., polymers the repeat unit of which contains an -O- group in the main chain (HTP2 and ETP1), however, no pendant chain attached to those polymers is disclosed. Therefore, the requirement of Formula (2) of the present Application is not suggested by HTP2 or ETP1.

There is evidence of record that the claim requirements provide unexpected results. In Tables 5 (page 106) and 7 (page 107) of the present Application, it is clearly demonstrated that, when a carbazole group (a hole transporting group) is attached to the main chain of the polymer of the present Application as a pendent chain (Namely, attached to Ar₂ of Formula (2)), unexpectedly excellent properties were obtained compared to when the same carbazole group is attached to the main chain of a vinyl polymer as a pendent chain as disclosed by Tokito et al.

More specifically, as shown in Table 5, Organic EL Element 2-1-12 contains PO-8 as a host material and Ir-1 as a phosphorescent material in the Light Emitting Layer. PO-8 is a polymer represented by Formula (2) of the present Application, in which Ar₂ is Ar-11 in page 19 of the present Specification to which a carbazole group is pendent.

On the other hand, Organic EL Element 2-1-1 contains PVK (polyvinyl carbazole) as a host material and Ir-1 (the same as in 2-1-12) as a phosphorescent material in the Light Emitting Layer.

PVK is a polymer in which a carbazole group is pendent to the main chain of a vinyl polymer, this polymer being illustrated in Tokito et al. as a part of P4 in [0095]. Accordingly, PVK is one of the polymers disclosed by Tokito et al.

As shown in Table 7, Organic EL Element 2-1-12 exhibits a 250% higher External quantum efficiency, a 711% longer Emission Life and a 20% lower Driving voltage compared to those of Organic EL Element 2-1-1.

It is therefore submitted that drastically improved properties were obtained by changing the main polymer chain of Tokito et al. to the main polymer chain of the present Application while attaching the same pendent group to both the main chains.

Thus the unexpected effect of changing the main polymer chain of Tokito et al. to the main polymer chain of the present Application while using the same pendent chain is clearly shown by the Examples of the present Application.

Such an effect of attaching the pendant chain of Tokito et al. to the polymer of Takimoto et al. cannot be expected by one of ordinary skill in the art.

Accordingly, claim 3 of the present Application is not obvious over Takimoto et al. and Tokito et al. in combination.

According to the same argument, claim 9 of the present Application is not obvious over a combination of Takimoto et al. and Tokito et al.

Claims 3, 4, 6, 7, 8, 15-17 and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takimoto et al. (US 5,331,182A) in view of Ikehira et al. (US 2002/0193532 A1).

With respect to claim 3, Takimoto et al. does not explicitly disclose the polymer containing pendent chains attached to Ar₂, as the Examiner states.

The Examiner also states that Ikehira et al. teach attaching pendent chains of phosphorescent complexes to the polymer backbone [0044]. The phosphorescent organometallic complexes are taught to have structures of instant formulas (5) and (7) [0044].

As one of the aspects of the invention of Ikehira et al., Ikehira et al. disclose a polymeric light emitting substance

having, in the side chain, a metal complexes structure showing light emission from the triplet excited state[0037].

However, it is also disclosed by Ikehira et al. that the main chain of the polymeric light emitting substance preferably comprises a conjugated polymer[0039].

Actually, many of the main chains disclosed by Ikehira et al. are conjugated polymers, for example, in [0040], [0044], [0113] and [0120].

In [0065] of Ikehira et al., it is also disclosed that "In view of light emitting efficiency, it is suitable that one or more of the repeating units represented by the formula (2) below are contained as a repeating unit other than that represented by the above formula (1)". Namely, a repeating unit represented by formula (2) may further be contained in the main chain in combination with the repeating unit represented by the formula (1) which forms a conjugated polymer in the main chain of the polymeric light emitting substance of Ikehira et al.

In the same manner, a repeating unit represented by formula (5) may also be contained in the main chain in combination with the repeating unit represented by the formula (1).

Namely, the polymer of Ikehira et al. preferably always contains a conjugated polymer. Therefore, it is expected that this is the best mode.

However, the main chain of the polymer represented by Formula (2) of the present Application contains no conjugated polymer.

Accordingly, Ikehira et al. teach away from the polymer represented by Formula (2) of the present Application, the main chain of which contains no conjugated polymer.

Accordingly, no one of ordinary skill in the art would be motivated to attach the pendent chain of Ikehira et al. to the polymer main chain of the present Application.

Accordingly, claim 3 of the present Application is not obvious over Takimoto et al. and Ikehira et al.

According to the same discussion, claim 9 of the present Application is not obvious over Takimoto et al. and Ikehira et al.

Therefore, in view of the above, the rejections of claims 3 and 9 should be withdrawn.

Since claims 4-8 and 15-18 are dependent to claim 3, and claims 19-22 are dependent to claim 9, the rejections of these claims should also be withdrawn as including patentable subject matter of the claim from which they depend.

New Claim 27 is added to subject matter (heterocyclic group) not in Claim 1 as now amended. In new claim 27, Ar₁ represents a group represented by Ar-63. Ar-63 is an aromatic group having an alkyl group as a substituent.

No aromatic group having an alkyl group as a substituent is exemplified in the text or in the examples of Takimoto et al.

Among the aromatic groups having an alkyl group as a substituent, Ar-63 is used in Poly-5 in page 26 of the Specification and tested in the Example in the hole transport layer and in the light emitting layer of Organic EL Element 1-1-3 (Table 5, page 106).

In Table 3, it is shown that Organic EL Element 1-1-3 exhibits a high External quantum efficiency, a long Emission Life and a low Driving voltage.

Takimoto et al. show or suggest nothing about such an excellent effect of Ar-63.

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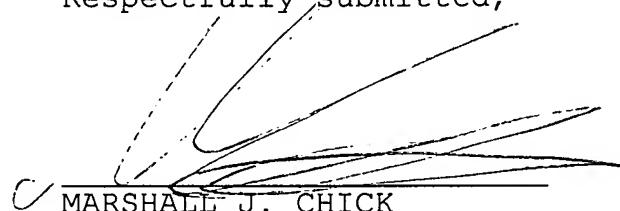
Accordingly, new claim 27 is not shown or suggested by the art.

In view of the above, the rejections are avoided. Allowance of the application is therefore respectfully requested.

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